

Table of Contents *(scroll or use links below to navigate document)*[What They Do](#)[Tasks](#)[Skills, Knowledge, and Abilities](#)[Work Environment](#)[California's Job Outlook and Wages](#)[Trends](#)[Training](#)[Where Do I Find the Job?](#)[Where Can the Job Lead?](#)[Other Sources](#)[View Career Video](#)**What They Do**

Chemical Engineers convert scientific discoveries into marketable products. They are involved in many aspects of chemical production, research, and design, as well as in the construction and operation of industrial plants. Chemical engineering is a diverse and complex profession. Frequently, Chemical Engineers specialize in one area, such as food, pharmaceuticals, heat transfer and energy conversion, petrochemicals, or consumer products such as plastics, detergents, paints, and synthetic textiles. Others specialize in one particular aspect of chemical production, such as oxidation, evaporation, or polymerization.

Chemical Engineers develop equipment for the manufacture of chemicals and related products and for the prevention of air, water, and soil pollution. They conduct research to develop new manufacturing processes, analyze operating procedures, equipment and machinery functions, and make recommendations for reducing processing time and cost. They design equipment for safe storage and transportation of chemical solids, liquids, and gases, as well as design control systems for chemical plants based upon data from lab experiments and pilot plant operations. Chemical Engineers also perform tests and take measurements in order to determine the most efficient production methods and develop instrumentation and control systems that will safely and economically produce the highest quality product.

Tasks

- ▶ Develop processes to separate components of liquids or gases or generate electrical currents, using controlled chemical processes.
- ▶ Conduct research to develop new and improved chemical manufacturing processes.
- ▶ Design and plan layout of equipment.
- ▶ Design measurement and control systems for chemical plants based on data collected in laboratory experiments and in pilot plant operations.
- ▶ Determine most effective arrangement of operations, such as mixing, crushing, heat transfer, distillation, and drying.
- ▶ Perform laboratory studies of steps in manufacture of new product and test proposed process in small scale operation (pilot plant).
- ▶ Perform tests throughout stages of production to determine degree of control over variables, including temperature, density, specific gravity, and pressure.

Chemical Engineers

- ▶ Develop safety procedures to be employed by workers operating equipment or working in proximity to on-going chemical reactions.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O*NET) at online.onetcenter.org.

Important Skills, Knowledge, and Abilities

- ▶ Science — Using scientific rules and methods to solve problems.
- ▶ Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- ▶ Operations Analysis — Analyzing needs and product requirements to create a design.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Chemistry — Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- ▶ Engineering and Technology — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- ▶ Physics — Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- ▶ Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.
- ▶ Written Expression — The ability to communicate information and ideas in writing so others will understand.
- ▶ Originality — The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
- ▶ Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

Work Environment

Most Chemical Engineers work in various locations at manufacturing plants. This includes planning and evaluating projects in an office setting, doing research and conducting tests in a lab, or troubleshooting on the production line. Some also work in their company's administrative offices, while others with advanced degrees are employed in research and teaching positions in colleges and universities.

Chemical Engineers usually work a regular 40-hour workweek. However, they may work irregular or long hours to meet deadlines when working on special projects. Also, some plants operate around-the-clock operations which may require shift work.

Many Chemical Engineers are members of the American Institute of Chemical Engineers and its local affiliates.

California's Job Outlook and Wages

The California Outlook and Wage chart below represents the occupation across all industries.

Standard Occupational Classification	Estimated Number of Workers 2004	Estimated Number of Workers 2014	Average Annual Openings	2006 Wage Range (per hour)
Chemical Engineers				
17-2041	2,200	2,600	110	\$31.53 to \$47.20

Wages do not reflect self-employment.

Average annual openings include new jobs plus net replacements.

Source: www.labormarketinfo.edd.ca.gov, Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.

Trends

The growth of Chemical Engineering jobs is expected to be faster than average compared with all occupations in the next few years. Chemical companies will continue to research and develop new chemicals and more efficient processes to increase output of existing chemicals. Among manufacturing industries, pharmaceuticals may provide the best opportunities for job seekers. Many of the jobs for Chemical Engineers, however, will be in nonmanufacturing industries, such as research and testing services. Additionally, about 700 openings will result from the need to replace Chemical Engineers who transfer to other occupations or leave the labor force.

Training/Requirements/Apprenticeships

A bachelor of science degree in chemical engineering is the most common entry-level requirement. A master's degree or higher is required for some research, teaching, consulting, and managerial positions. College graduates whose degrees are in mathematics or chemistry may also qualify for some positions. Employers look for applicants who can communicate ideas, are analytical and innovative, and are adept at solving problems.

Passing a State board exam given by the Department of Consumer Affairs is required to do consulting work. In order to keep up with rapid changes and advances in the field, many Chemical Engineers advance their education throughout their careers by attending continuing education courses.

Chemical Engineers

Chemical Engineers must be able to communicate their ideas to managers, technicians, craftworkers, production workers, and customers, as written reports and oral presentations are often an important part of the job. They must be able to work closely with scientists and other engineers as part of a team, and be analytical and innovative. They must also be adept at solving problems and taking initiative, and be able to make sound, timely decisions. Because Chemical Engineers use computer technology to optimize all phases of research and production, they need to understand how to apply computer skills to chemical process analysis, automated control systems, and statistical quality control.

Recommended High School Course Work

High school preparation courses in mathematics and science courses including trigonometry, calculus, biology, chemistry, physics, and computer science are helpful. Other courses such as language arts, economics, and electronics are also useful to Chemical Engineers.

Where Do I Find the Job?

Employers who hire entry-level Chemical Engineers usually recruit applicants at colleges and universities. They conduct on-campus interviews with interested students. Chemical Engineers may also find employment by submitting résumés and applying directly to companies that hire engineers in their specialty, or by replying to ads in newspapers and professional journals. Personal contacts through professional organizations or recommendations by employees of a company are also common ways of finding work. Applying to federal and other governmental agencies and taking the appropriate examinations may also lead to employment in this field.

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at www.labormarketinfo.edd.ca.gov to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Electricity & Signal Testing Instruments
- ▶ Electromedical Apparatus
- ▶ Engineering Services
- ▶ Industrial Process Variable Instruments
- ▶ In-Vitro Diagnostic Substance
- ▶ Landscape Architectural Services
- ▶ Medicinal and Botanical
- ▶ Other Biological Product
- ▶ Pharmaceutical Preparation
- ▶ Physical/Engineering/Biological Research
- ▶ Search, Detection, & Navigation Instruments
- ▶ Social Science/Humanities Research
- ▶ Testing Laboratories

Search these **yellow page** headings for listings of private firms:

- ▶ Engineers-Chemical
- ▶ Engineers-Manufacturing
- ▶ Engineers-Consulting
- ▶ Engineers-Petroleum
- ▶ Engineers-Hazardous Waste
- ▶ Engineers-Sanitary
- ▶ Engineers-Industrial
- ▶ Engineers-Water Supply

Where Can the Job Lead?

Advancement opportunities exist along a structured career path for Chemical Engineers. They can advance to a Senior or Supervising Chemical Engineer within an organization. In some cases they may advance to managerial positions.

There are many lateral opportunities for Chemical Engineers. With their engineering college degree, they can actually move into many of the other occupations that might only require a degree in engineering.

Other Sources of Information

American Institute of Chemical Engineers
www.aiche.org

American Chemical Society
www.chemistry.org

